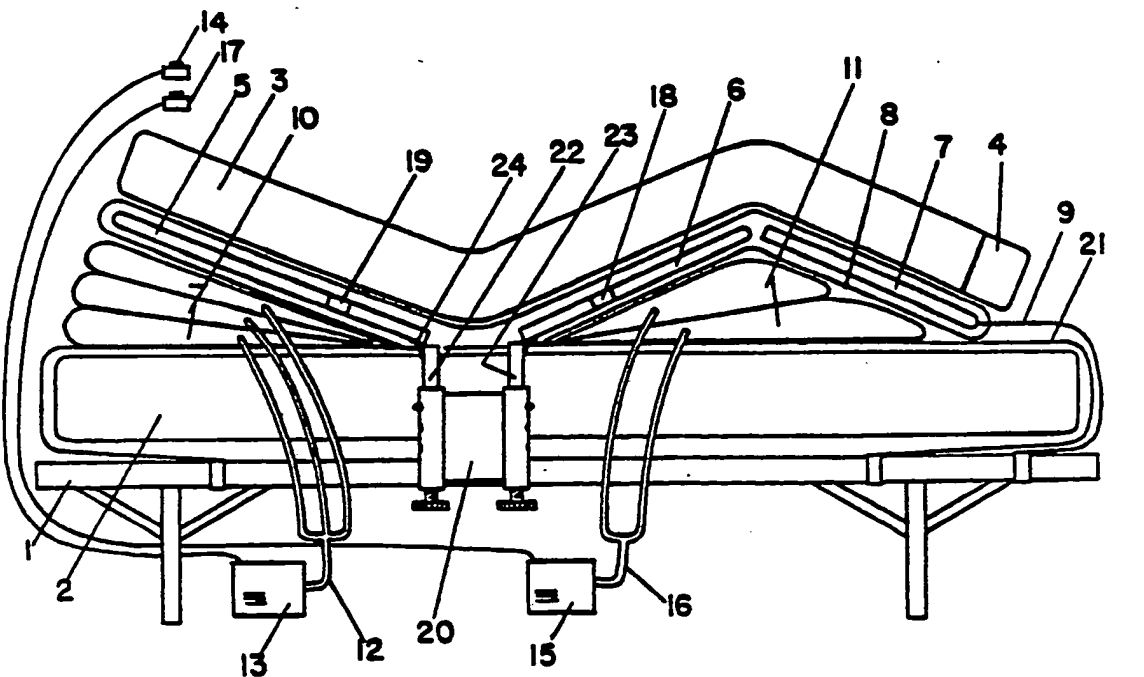




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification<sup>4</sup> : <b>A47C 27/10</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 88/ 09140</b> (43) International Publication Date: 1 December 1988 (01.12.88)</p>
<p>(21) International Application Number: PCT/US88/01287 (22) International Filing Date: 20 April 1988 (20.04.88) (31) Priority Application Number: 054,208 (32) Priority Date: 26 May 1987 (26.05.87) (33) Priority Country: US  (71)(72) Applicant and Inventor: WILLIAMSON, Robert, M. [US/US]; 1708 Matthews Lane, Austin, TX 78745 (US). (74) Agent: LONG, Joseph, F.; 1411 West Avenue, Suite 101B, Austin, TX 78701-1537 (US).  (81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent).</p>		<p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: AN ADJUSTABLE BED SYSTEM</p>  <p>(57) Abstract</p> <p>An adjustable bed system comprising inflatable bags (10, 11) under a hinged mattress support frame (5, 6, 7) with necessary air blowers (13, 15) to raise or lower a head end and leg end of the mattress (3), the total unit being portable and adapted to fit any size bed.</p>		

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AN ADJUSTABLE BED SYSTEMBACKGROUND OF THE INVENTION

1 Even though there have been several patents issued for various devices or systems to raise or lower portions of a bed to improve comfort and change position of the occupant most have not been widely accepted. With increasing need for  
5 care for those bedridden for either short or long duration there is an increasing need for such occupants to perform as many functions as practicable for themselves. Further a proper adjustable system would allow increased comfort for those many people who read or watch TV while in bed. As yet  
10 we find no economical, easily used, and easily installed system for operation by the occupant for adjusting either or both the "head" portion and "leg" portion of a bed. We have considered the following patents in this general area:

<u>PATENT NUMBER</u>	<u>INVENTOR</u>	<u>DATE</u>
15 1,769,182	E. J. NUNLIST	11/6/1956
3,392,723	C. E. CALVIN	7/16/1968
3,392,412	J. R. AYMAR	7/16/1968
3,606,623	J. R. AYMAR	9/21/1971
3,667,075	W. D. BALLARD, et al	6/6/1972
20 3,978,530	J. G. AMARANTOS	9/7/1976
4,287,620	H. C. ZUR	9/8/1981
4,309,783	M. A. CAMMACK	1/12/1982

None of these fill the needs as outlined below for this invention. This present invention fills the need for:

- 25 1. a low cost system to adjust portions of a bed;

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1        2. a system easily operable by fingertip control of the occupant;

3. a system variably adjustable within safe limits to raise either or both "head" portion of the bed and "leg" portion of bed;

4. a system that smoothly returns the bed to normal flat position;

5. a system intrinsically safe and easily sanitized;

6. a system with easily replaceable and readily available parts. The invention utilizes air bags below a hinged frame to raise the "head" portion of the bed and in the same manner utilizes a second set of air bags to raise the portion of the bed below the occupant's knees. The system has several unique features designed for ease of installation, ease and economy of manufacture, low cost transportation, ease of sanitation and economical parts replacements. The system is designed to be used with a normal bed and with variation in size may be used with a single bed, a double or standard bed, a queen size or a king size bed.

Briefly, the system comprises,

1. a metallic frame which may be of aluminum pipes which may be approx. 1" in diameter; the frame is hinged on either side of the bed and on either side of a flat section which may be about one foot in length with the flat section made to be fastened to the bed frame

2. a canvas cover for the total frame with approximately 2" thick polyurethane section or similar spongy

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1 material inside the canvas and inside the frame so that when  
the frame is slipped between the mattress and box springs the  
mattress continues to be flat but approximately 2" higher  
from the floor

5 3. a first pair of motor-blowers both to inflate and  
deflate the bags under the head portion of the bed and second  
pair of motor-blowers similarly to inflate or deflate the  
bags under the "foot" or "leg" portion of the bed

4. an electrical system with switches available to the  
10 occupant of the bed with necessary safeguards

5. pressure and vacuum cut offs to prevent  
overpressure of the bags or burn out of the motors by  
operation against a closed suction.

The motor-blowers used were standard vacuum cleaner  
15 motors (which have blower built in). Vacuum cleaner  
motor-blowers are commonly used with the air blowing back  
over the motor. The unique deflation-inflation set up in  
this invention may be briefly described in an overall way in  
the following paragraphs.

20 A vacuum cleaner motor-blower fits very neatly into a  
piece of 4 1/2" PVC pipe and one motor-blower is slipped into  
the pipe with the motor facing in; a spring that fits loosely  
into the pipe is then slipped in and the second motor-blower  
is slipped in facing out so that we then have a spring  
25 separating the motor-blowers. We may activate one to blow  
air toward an inlet end of the assembly and, with this one  
deactivated the other one will pull air over the one that is  
deactivated so that by turning on one the air bags hooked to

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1 one end of this assembly will be inflated; by shutting off  
the one used to inflate the bags and activating the other the  
bags will be deflated.

One end of the assembly is closed with a cap containing  
5 an outlet fitting that fits closely into the pipe to hold the  
motor-blower while the other end is closed with a similar end  
cap that slips completely within the straight section of  
plastic pipe to hold the other motor-blower firmly against  
the spring separating the two motor-blowers. This end or  
10 terminal cap contains an opening that may fit against a  
diaphragm in a third end cap that fits within the straight  
piece of pipe. This third cap contains an air chamber behind  
the diaphragm and an equalizing line between this air chamber  
and the chamber formed where the spring holds the two  
15 motor-blowers apart. When the diaphragm in the third end cap  
is lifted up from the second end cap there is communication  
with the chamber formed over the top of the bell shaped  
second end cap. This chamber contains several holes which  
may be of 3/4" diameter leading to the outside air.

20 In operation when the motor-blower is activated a vacuum  
is pulled on the spring containing chamber, the equalizing  
line from this chamber to the chamber in the third end cap  
pulls a slight vacuum in this third cap chamber thereby  
pulling the flexible diaphragm away from the second cap  
25 opening so there is then a path to pull outside air over the  
inactive "deflation" motor-blower, through the spring chamber  
and thence to inflate the air bags hooked to the first end  
cap via flexible tubing. When inflation to a desired point

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1 is completed and motor-blowers deactivated the diaphragm becomes an efficient check valve to hold air in bags.

In order to deflate the bags the "inflation" motor-blower is deactivated and the "deflation" motor-blower 5 activated. Because of the equalizing line between the spring chamber and third end cap the pressure on either side of the diaphragm is the same but as soon as the "deflation" motor-blower is activated the blower outlet pressure will raise the diaphragm providing an air path to the exterior.

10 This briefly describes a unique system that meets the objectives outlined. Total weight of the system may be less than 75 pounds so that it is easily portable and shippable. The mass produced vacuum cleaner motor-blowers are quite inexpensive and fit into inexpensive housings. In fact the 15 system used for deflation or inflation of the bags may be cheaper than an alternative system using only one motor-blower with a complex valving system. Various details have been left out of the above brief outline for clarity and brevity but would be easily supplied by one of normal skill 20 in mechanical and electrical arts. A more complete explanation of a preferred embodiment will be found in the remaining specification and claims.

Many minor changes in details of this invention could be made but would still come within the spirit and purpose and 25 fulfill the objectives outlined. For example, the support frame could be of molded plastic with hinges molded in the frame; the motor-blower pair could be replaced with one motor-blower and with microprocessor controlled valving or

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1 could be replaced with one blower for inflation and one for deflation with proper valving.

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## STATEMENT OF THE INVENTION

1 The present invention comprises:

a) a support assembly consisting of a cloth or canvas fitted over a hinged frame and containing foamed polyurethane in such manner as to maintain the mattress flat in the rest position but to have canvas easily removed for washing;

b) in a first embodiment a canvas bellows comprised of multiple bags with each canvas bag replaceably containing a plastic or rubber inflatable pillow shaped bag and designed so as to be placed under the foregoing hinged frame to raise portions of the bed by inflating the bellows; in a second embodiment the plastic bags may be made in one or two units and used without the canvas bag containers;

c) an easily replaced inflatable bag contained in each of the bellows in the first embodiment so that all bags may be temporarily removed for washing the canvas bellows or alternatively in the second embodiment only plastic bags are used and they may be sanitized with commercially available agents or cheaply replaced;

d) two assemblies each containing motor-blower units, air chambers, and a simple diaphragm valve to allow inflation of the plastic bags to raise the bed to any desired position and to remove the air to allow smooth return of the bed to the flat or "rest" position;

e) a three position switch for each motor-blower assembly to allow finger tip control so one motor-blower fills the bellows to raise the "head" portion of the bed with the switch in one position whereas putting the switch in the

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1 other active position activates the other motor-blower to  
evacuate the bellows to return bed smoothly to flat position;

f) a switch and motor-blower assembly raises and lowers  
the "leg" portion of the bed in the same way as outlined for  
5 the "head" portion;

g) cut-off switches position-activated to cut off the  
blower when the head portion or leg portion reaches a desired  
maximum elevation; a normal mercury switch may be properly  
positioned in the hinged frame to accomplish this function;

10 h) means to anchor the hinged support frame to the bed  
frame; in one embodiment two pipes on each side of the bed  
were connected to the support frame and were fitted into two  
larger pipes fastened to a steel plate with the plate then  
clamped to the bed frame;

15 i) means to hold down the foot end of the hinged frame  
so that inflation of the bags raises the mattress in the knee  
area;

j) a retainer bag fastened over the foot of the  
mattress and then tied to the bed frame to prevent the  
20 slippage of the mattress that would otherwise occur as the  
air bags are inflated.

A plastic support frame of sufficient rigidity could  
replace the hinged support frame we have described in detail.

As described the hinged frame with bags deflated and  
25 hoses disconnected that led from the motor-blower units will  
fold neatly into a package easily carried by one man. The  
motor-blower units, wiring and hoses may be neatly fitted  
into a second carrying case and are also easily carried.

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1 This portability and ease of installation is an important  
feature of the system. It is anticipated that a major use  
may be for those people who relax and read or watch TV in  
bed. Of course the invention also fulfills the need for  
5 temporary conversion of a normal bed to be similar to a  
hospital bed.

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BRIEF DESCRIPTION OF THE DRAWINGS

1     Fig. 1 shows a side view of the Adjustable Bed System in use with a mattress with both head portion and leg portion in a raised position.

5     Fig. 2 shows top view details of a support frame used below the mattress and above the inflatable bags used to raise and lower either the head portion or leg portion of the mattress.

Fig. 3 shows side view details of the support frame.

Fig. 4 shows details of a clamp used to anchor the  
10 support frame firmly to the bed rails.

Fig. 5 shows one embodiment of an air bag assembly used below the Hinged Support Frame, Fig. 2.

Fig. 6 shows a second embodiment of an air bag assembly that may be used below the Hinged Support Frame, Fig. 2.

15     Fig. 7 shows details of a first motor-blower unit that may be used to inflate and deflate air bags shown in Fig 4. or Fig. 5 on the head end of the system.

Fig. 8 shows a second motor-blower unit (exactly the same as this first motor-blower unit) used to deflate and  
20 inflate air bags shown in Fig. 4 and Fig. 5 under the head end and leg end of the mattress with cut offs of this unit by position switch in the "head" and "leg" end of the assembly frame.

Fig. 9 shows detail of an electrical circuit for the  
25 first motor-blower unit.

Fig. 10 shows a second electrical circuit similar to the electrical circuit, Fig. 7 for the second motor-blower unit.

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DETAILED DESCRIPTION OF THE DRAWINGS

1      Fig. 1 shows a side view of the Adjustable Bed System with both the head end and leg end of the mattress in a raised position. In Fig. 1 we show a bedframe 1, box spring 2, mattress 3, a cloth mattress retainer 4 that may be sewed 5 to the canvas bag covering 8; this canvas bag covering 8 holds in one unit a first section 5, a second hinged section 6 and a third section 7 of the assembly mattress support unit. The first section 5 may be approx. 1" diameter tubular aluminum pipe bent in a U shape and terminating in a hinged 10 portion 22 on each end of the U shape, this hinge portion 22 with hinge 24 being outside the canvas bag covering 8. A second hinge section 6 is of similar shape but with each leg of the U being shorter than in the first section 5. In a similar fashion to the first section 5 this second section 6 15 is a U shape frame but facing the opposite direction from section 5 and terminating on each leg of the U with a hinged portion 23 designed to fit into the receiving pipes on clamp 20 in the same way as ends 22. The second section 6 contains an electrical switch 18 which may be a mercury switch 20 designed to break an electrical circuit when section 6 is in a maximum raised position. In the same way section 5 contains a similar electrical switch 19. A third section 7 is also U shaped with the legs of the U terminating in rounded ends with these legs pointing toward the center of a 25 bed when the assembly is in use. Not shown here but indicated in Fig. 2, 26 are two sections of polyurethane foam approx. 1 1/2" thick with one section filling the space

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between sections 5 and 6 and a second section filling the space in section 7. Other spongy type materials would serve the same purpose of allowing the mattress 3 to be flat when air bags 10 and 11 are deflated. Completing the hinged support assembly as already described are tie down straps 9 that tie each end of the U shaped frame 7 loosely to the bed frame or bed rails 1. These straps 9 allow the mattress 3 to move sufficiently to form the raised leg portions as shown by holding the very lower end close to the box springs to cause the air bags 11 to give desired mattress position as shown when inflated. Anchor straps 21 hold the air bags canvas covering 8 in place. A three position switch 17 operates motor-blower unit 15 and a similar three position switch 14 operates motor-blower unit 13. Inlet lines 12 go to head end air bags and inlet lines 16 go to leg end air bags 11.

In Fig. 2 we show a top view of the assembly support unit with the first section 5 terminating in hinged pieces 22 connected by hinge 24; the second section 6 terminating in hinged portions 23 connected by hinges 25 and the third section 7 terminating in rounded ends and being loosely tied down to the bed frame with tie down straps 9. Cutaway sections of the canvas bag or envelope 8 that holds the assembly together show the 1 1/2" thick polyurethane sections 26 that "fill" the canvas envelope 8 so that when air bags 10 and 11, Fig. 1 are deflated the mattress 3, Fig. 1 lies flat on the air bag unit 21, Fig. 5 or 39, Fig. 6 which lies on top of the box springs 2, Fig 1. Position cut-off switches 19, Fig. 1 on head end 18, Fig 1 on leg limit upward position

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lof head end and leg end.

Fig. 3 is a side view of the support assembly showing hinged section 22 and hinge 24 of section 5 which would be outside the canvas envelope 8 and contains a spring loaded pin 30, which pin allows height adjustment in clamp 20, Fig. 1. Similarly hinged section 23 with hinge 25 of section 6 contains a spring loaded pin 31 which also fits into Clamp 20, Fig. 1. Section 7 is contained in the canvas envelope 8 along with sections 5 and 6. Tie down straps 9 serve to hold down the lower end of section 7.

Fig. 4 shows Clamp 20 and sections 22 and 23 of the support assembly hinged sections 5 and 6 with hinges 24 and 25. A spring loaded pin 30 is contained in section 22 with section 22 being conveniently made from aluminum pipe. The spring loaded pin 30 may be made as indicated but other ways of making a spring loaded pin would be equally suitable. Spring loaded pin 31 is similar to spring loaded pin 30 and is inside a tubular section 23. Tubular sections 33 and 34 are larger than tubular sections 22 and 23, contain spaced openings to secure spring loaded pins 30 and 31, and are rigidly connected to flat plate body of Clamp 20. Screw clamps 35 may be used to clamp body 20 securely to the bed rails 1, Fig. 1. There is a similar set up on each side of the bed, and sections 5 and 6 of the support assembly may be rigidly clamped in place.

Fig. 5 shows one preferred embodiment of the air bag unit 21 wherein plastic inflatable bags 10 on the head end and 11 on the leg end are contained in canvas envelopes 8.

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1 Connections 12 are shown for each of the head end air bags 10 and connection 16 for the leg end bags both of which may be 3/8" plastic nipples formed in the inflatable plastic bags 10 and 11. We have shown three bags in the head end and two 5 bags in the leg end and all bags are shown equal size and this embodiment works well. However, the number and size of the air bags could vary and come within the spirit of this invention. The canvas bags of the air bag covering 8 may be conveniently made by folding and sewing one piece of canvas 10 but methods of manufacture would be easily varied by one of ordinary skill in the trade. Tie down straps 9 are used to hold the air bags covering 8 in proper position on top of box springs 2, Fig. 1.

Fig. 6 shows a second embodiment of the air bags 40 to 15 lift the head end and air bags 43 to lift the leg end of a mattress. Inlet-outlet nipples 41 and 42 for the air bags may be 3/8" diameter plastic fused into the plastic air bags. The bottom portion of the air bag unit 39 is connected to all air bags by fusion, sewing or glueing to a canvas section 20 with tie down straps 44 to tie to bed rails 1, Fig. 1 to anchor unit 39 in place.

Fig. 7 shows one unit containing two common vacuum cleaner motor-blower units. There are two of these units, one, Fig. 7 being for inflation and deflation of the air bags 25 at the head end and the other exactly similar unit Fig. 8 being to inflate or deflate the air bags at the foot end of the unit.

Looking at Fig. 7 the unit may be conveniently assembled

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1 by glueing end cap 58 and terminal cap 59 into a first end of  
pipe 69 which contains up to eight holes 57 that may be 3/4"  
in diameter between end cap 58 and lower portion of terminal  
cap 59, the terminal end cap 59 containing a flexible  
5 diaphragm 56, an air chamber 55 and a connection for the  
equalizing line 62. The motor 51 and attached blower 50 is  
pushed into pipe section 69 to fit snugly against the end cap  
58. A spring 63 that may be 3" in diameter and exert up to  
15 pounds force when compressed to approx. 1" is placed  
10 between blower 50 and the second blower 52. This spring space  
forms chamber 64 which communicates with the end cap 59  
through equalizing line 62 which may be 1/2 inch in diameter.  
End cap 68 may then fasten in a second end of pipe 69 so as  
to seat against blower 52 and to properly compress spring 63.  
15 End cap 68 may contain a positive pressure relief valve 61, a  
vacuum relief valve 67, a vacuum operated electrical cut off  
switch 60 and an outlet nipple 66.

Operation of this dual two way blower we have described  
will be as follows:

- 20 1. When blower 52 is activated by a two way  
electrical switch 14, Fig. 9, the blower will pull a vacuum  
in chamber 64, Fig. 7, and through the equalizing line 62 the  
pressure will be reduced in chamber 55 causing the flexible  
diaphragm 56 to lift off the seat on the end cap 58 and  
25 outside air may then flow through holes 57 over the inactive  
blower 51 and thence through chamber 64 and over motor 53 to  
outlet nipple 66 which is hooked to inflate plastic bags,  
Fig. 5 or Fig. 6. The pressures and sizes of equalizing line

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162, diaphragm 56 and holes 57 are such in the unit as described that air continues to flow to inflate the bags until the user throws the switch 14 or until the position switch 18 or 19, Fig. 1 deactivates the motor 53. When the 5 bags are inflated and motor 53 is deactivated back pressure through the equalizing line 62 pressures chamber 55 so that this pressure causes flexible diaphragm 56 to close firmly -- the diaphragm acts as a very efficient check valve to hold the bags inflated.

10        When the occupant wishes to lower the head end of the bed by deflating the plastic bags on the head end he pushes the two way switch 14, Fig. 9, so that motor 51 is activated to start blower 50. The pressure in chamber 64 is equalized with the pressure in chamber 55 but the output 15 pressure in chamber 54 from blower 50 coupled with a slight pressure reduction in chamber 64 and thereby in chamber 55 is sufficient to lift diaphragm 56 so that air from the plastic bags may flow to the outside through holes 57. When the air is completely removed from the bags the pressure will drop in 20 chamber 65 and vacuum switch 60 will stop the motor 51 if the activation switch 14, Fig. 9, is in the closed position. This prevents motor 51 burn out by automatically shutting off motor 51 when bags are completely deflated.

Fig. 8 shows the second dual motor-blower unit which is 25 used to inflate or deflate the bags at the leg end of the bed. Briefly, since we have described the similar unit in detail, we see blower 80 and motor 81 used for deflation contained in a bell shaped cap 99 with air chamber 84

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communicating with outside air through holes 87 in containment structure or pipe 91 when flexible diaphragm 86 is in a raised position. Chamber 85 formed by cap 100 and flexible diaphragm 86 will be equalized in pressure with spring chamber 94 through equalizing line 92.

Blower 82 and motor 83 serve to inflate leg end bags and are held in place by spring 93 and end cap 98. End cap 98 contains chamber 95, nozzle 96, a vacuum cut off switch 90 and a vacuum relief valve 88 and pressure relief valve 89.

Fig. 9 shows the electrical circuits used with the dual motor blower units used for inflating and deflating the head end bags 10, Fig. 1 and described in detail under Fig. 7. In the circuits there is shown a 110V source 75 with one side of the circuit leading to a switch 14, this switch may be spring loaded to return to an open position with fingertip control to inflate or deflate with head end bags 10, Fig. 1. The switch may also be replaced or activated by a pneumatic controlled switch that will act the same as switch 14. Various other type switches may be used to perform functions of switch 14. When switch 14 is positioned to closed the circuit through position switch 19 (shown in place Fig. 1) through motor 53 and back to inlet 110V connection 75 the air bags 10, Fig. 1 will inflate. Note, using the desirable spring loaded-to-open switch 14 the bed will stay in position after inflation of the air bags because of diaphragm 56, Fig. 7 acting as a check valve as previously explained. When switch 14 is depressed to close the circuit through vacuum cut off switch 60, Fig. 7 and through motor 51 back to 110V

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110, Fig. 1; the vacuum cut off switch 60 will open to stop motor 51 if the occupant continues to hold switch 14 in position after bags 10, Fig. 1 are completely deflated. This is desirable to prevent damage to motor 51.

5 Fig. 10 shows an exactly similar circuit to that of Fig. 9 but is included here for clarity. Briefly, the circuit shows inlet 110V source 76 with one leg of the 110V circuit leading to a central pole of two pole switch which is loaded to open. When switch 17 is positioned by the occupant to  
10 close the circuit through position switch 18, Fig. 1 the motor 82 will be activated and blower 83 will then act to inflate the leg end bags 11, Fig. 1. The position switch 18 will operate to deactivate motor 82 when the maximum desirable elevation of the lower portion of the bed is  
15 reached even if the occupant holds the switch 17 in a closed position too long.

When switch 17 is depressed so as to close the circuit through vacuum cut off switch 90 and through motor 81 the blower 80 is activated to deflate leg end bags 11, Fig. 1.  
20 Vacuum cut off switch 90 deactivates motor 81 if the occupant holds switch 17 in place too long. This protects motor 81.

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BRIEF DESCRIPTION OF NUMBERS ON DRAWINGS

- 1 Bedframe
- 2 Box spring
- 3 Mattress
- 4 Cloth mattress retainer
- 5 A first section of the assembly
- 6 A second section of the assembly
- 7 A third section of the assembly
- 8 Canvas bag covering
- 9 Tie down straps
- 10 Air bags on head end
- 11 Air bags on leg end
- 12 Head end air connection
- 13 Motor-blower unit for head end
- 14 Two way switch -- spring loaded for open
- 15 Motor-blower unit for leg end
- 16 Leg end air bag connection
- 18 Position activated switch in second section 6
- 19 Position activated switch in first section 5
- 20 Clamp with receiving pipes
- 21 Anchor straps for air bag unit
- 22 Hinged portion of section 5
- 23 Hinged portion on section 6
- 24 Hinge on section 5
- 25 Hinge on section 6
- 26 Two section of polyurethane foam
- 30 Spring loaded pin in 22
- 31 Spring loaded pin in 23

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- 33     Tubular sections of clamp to receive 22
- 34     Tubular sections of clamp to receive 23
- 35     Screw clamps
- 39     Air bag unit in second embodiment
- 40     Head end air bags of 39
- 41     Inlet-outlet connections on 40
- 42     Inlet-outlet connection on 43
- 43     Leg end air bags in second embodiment
- 44     Tie down straps for second embodiment
- 50     Blower of 50-51 motor-blower unit
- 51     Motor of 50-51 motor-blower unit
- 52     Blower of 52-53 motor-blower unit
- 53     Motor of 52-53 motor-blower unit
- 55     Air chamber
- 56     Flexible diaphragm
- 57     Holes
- 58     End cap
- 59     Terminal end cap
- 60     Vac. operated cut off switch
- 61     Pressure relief valve
- 62     Equalizing line
- 63     Spring
- 64     Chamber containing spring 63
- 65     Air chamber - inlet end
- 66     Outlet connection
- 67     Vacuum relief valve
- 68     Inlet end caps
- 69     Containment structure on pipes

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- 75 110V source for motors 51 and 53 of Unit 13, Fig. 1
- 76 110V source for motors 81 and 83 of Unit 15, Fig. 1
- 80 Blower of motor-blower unit 80-81
- 81 Motor of motor-blower unit 80-81
- 82 Blower of motor-blower unit 82-83
- 83 Motor of motor-blower unit 82-83
- 84 Air chamber below diaphragm 86
- 85 Air chamber above diaphragm 86
- 86 Flexible diaphragm
- 87 Holes
- 88 Vacuum relief valve
- 89 Pressure relief valve
- 90 Vacuum cut off switch
- 91 containment structure or pipes
- 92 Equalizing line
- 93 Spring
- 94 Spring chamber
- 95 Air chamber - inlet end
- 96 Outlet connection
- 98 End cap - inlet end
- 99 Bell shaped cap - exit end
- 100 Terminal end cap

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CLAIMS

1 What is claimed is:

1. An adjustable bed system comprising:

A. a hinged mattress support frame

B. fastening means to hold said hinged mattress  
5 support frame to a bed above a box spring and below a  
mattress

C. a first inflatable means to raise and lower a  
head end of said hinged mattress support frame and a second  
10 inflatable means to raise and lower a leg end of said hinged  
mattress support frame

D. a first means to inflate and deflate said  
inflatable means to raise and lower said head end and a  
second means to inflate and deflate said inflatable means to  
15 raise and lower said leg end.

2. An adjustable bed system as in Claim 1 where said  
hinged mattress support frame comprises:

A. a first U shaped frame terminating in a first  
straight short section hinged perpendicular to a flat plane  
20 of said first U shaped support frame to fold back upon said  
first U shaped frame

B. a second U shaped frame with each leg of said  
second U shaped frame terminating in a second short section  
hinged perpendicular to a flat plane of said second U shaped  
25 frame to fold back upon said second U shaped frame

C. a third U shaped frame with legs of said third  
U shaped frame terminating with rounded ends

D. a cloth cover to fit over said first U shaped

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1 frame, said second U shaped frame, and said third U shaped  
frame when said legs of said first U shaped and said legs of  
said second U shaped frame are placed with said first and  
second short hinged sections facing and separated sufficient  
5 for said first and said second hinged section to fit into a  
fastening means to hold said hinged mattress support frame  
and with said rounded ends of said legs of said third U  
shaped frame placed adjacent to a top portion of said second  
U shaped frame; said cloth cover having openings so that said  
10 first short hinged sections of said first U shaped frame and  
said second U shaped frame remain outside said cloth cover

E. a first layer of a spongy material up to 3" in  
thickness to fit between said legs of said first U shaped  
section and said second U shaped section and a second layer  
15 of said spongy material up to 3" in thickness to fit between  
said legs of said third U shaped frame with said cloth cover  
fitting over said first U shaped frame, said second U shaped  
frame and said third U shaped frame when said when said first  
layer of a spongy material and said second layer of a spongy  
20 material are within said first, second, and third U shaped  
frames.

3. An adjustable bed system as in Claim 2 where a means  
to hold a foot end of said mattress closely adjacent to said  
hinged support frame attaches to said cloth cover.

25 4. An adjustable bed system as in Claim 2 where said  
first short hinged section, attached to said legs of said  
first U shaped frame, and said second short hinged sections  
attached to said legs of said second U shaped frame, each

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1contain a spring loaded pin extending through walls of  
terminal ends of both said first short hinged sections and  
said second short hinged sections.

5. An adjustable bed system as in Claim 4 where said  
5fastening means to hold said hinged mattress support frame  
comprises:

A. a clamp on each side of said bed with said  
clamp having a flat section; two open pipes, one connected to  
each side of said flat section, containing holes so  
10positioned that said spring loaded pins of said first short  
hinged section and said second short hinged section will  
adjustably fit into said pipes containing holes; clamps  
integrally attached to said flat section positioned so as to  
allow clamping said flat section to a bed rail with said open  
15pipes of said clamp in an upright position

B. tie down straps attached to a top portion of  
said third U shaped section of said hinged mattress support  
frame, that fit loosely over the ends of said mattress and  
said box springs to tie loosely to said bed frame in order to  
20allow some movement of said leg end of said mattress support  
frame.

6. An adjustable bed system as in Claim 1 where said  
first inflatable means and said second inflatable means  
comprise:

25 A. a flat cloth strip of a similar width and  
length of said mattress with tie down straps to go over said  
box springs and tie to said bed frame

B. a first multiplicity of cloth bags with opening

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1 to holdably receive inflatable plastic bags, fastened to a  
center portion of said cloth strip

C. a second multiplicity of cloth bags with  
openings to holdably receive inflatable plastic bags,  
5 fastened to said center portion of said cloth strip

D. a first multiplicity of said inflatable plastic  
bags each equipped with means to flexibly connect to each  
first means to inflate and deflate said inflatable plastic  
bags and each contained in a bag of said first multiplicity  
10 of cloth bags

E. a second multiplicity of said inflatable  
plastic bags equipped with means to flexibly connect to said  
second means to inflate and deflate said second multiplicity  
of plastic bags and each contained in a bag of said second  
15 multiplicity of cloth bags.

7. An adjustable bed system as in Claim 1 where said  
first means to inflate and deflate said inflatable means to  
raise and lower said head end comprises:

A. a first motor-blower with a discharge  
20 connecting with said first multiplicity of inflatable plastic  
bags and with a suction communicating with outside air  
through a chamber containing a spring, over and around a  
second motor-blower, under a flexible diaphragm contained in  
a diaphragm chamber and covering an opening in a bell shaped  
25 chamber containing a second motor-blower system; said  
diaphragm chamber communicating with said chamber containing  
a spring through a first equalizing line so that when said  
first motor-blower unit is activated a decrease in pressure

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1 in said chamber containing a spring causes a decrease in  
pressure above said flexible diaphragm in said diaphragm  
chamber thereby causing said flexible diaphragm to raise to  
uncover said opening in said bell shaped chamber containing  
5 said second motor-blower unit thus allowing air to come  
through holes contained in a chamber formed by a bell shaped  
end of said bell shaped chamber and containing a structure

B. said second motor-blower unit with suction of  
said blower of said motor-blower unit opening to said chamber  
10 containing a spring, with discharge of said blower of said  
motor-blower unit communicating to outside atmosphere through  
said chamber containing said second motor-blower unit and an  
opening covered with said flexible diaphragm contained in  
said diaphragm chamber and thence to outside air through  
15 holes contained in said chamber formed by said bell shaped  
end of said bell shaped chamber containing said second  
motor-blower unit; said flexible diaphragm being lifted by a  
combination of discharge pressure from said blower of said  
second motor-blower and a decrease in pressure in said spring  
20 chamber equalizing through said first equalizing line to  
reduce pressure in said diaphragm chamber above said flexible  
diaphragm

C. an electrical circuit containing a spring  
loaded two way switch with a connection through a first side  
25 of said two way switch to actuate said motor in said first  
motor-blower unit through a position switch in said second  
section of said hinged mattress support frame to inflate said  
inflatable plastic bags under said leg end of said mattress

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1 support frame, said position switch operating to open said  
circuits thereby stopping said first motor-blower unit when  
said leg section reaches a maximum position.

8. An adjustable bed system as in Claim 7 where said  
5 second means to inflate and deflate said inflatable means to  
raise and lower said leg end comprises:

A. a first motor-blower with discharge connecting  
with said second multiplicity of inflatable plastic bags and  
with a suction communicating with outside air through a  
10 chamber containing a spring, over and around a second  
motor-blower, under a flexible diaphragm contained in a  
diaphragm chamber and covering an opening in a bell shaped  
chamber containing a second motor-blower system; said  
diaphragm chamber communicating with a said chamber  
15 containing a spring through a first equalizing line so that  
when said first motor-blower unit is activated a decrease in  
pressure in said chamber containing a spring causes a  
decrease in pressure above said inflatable diaphragm in said  
diaphragm chamber thereby causing said flexible diaphragm to  
20 raise to uncover said opening in said bell shaped chamber  
containing said second motor-blower unit thus allowing air to  
come through holes contained in a chamber formed by a bell  
shaped end of said bell shaped chamber and containing  
structure

25 B. said second motor-blower unit with suction of  
said motor-blower unit opening to said chamber containing a  
spring, with discharge of said motor-blower of said  
motor-blower unit communicating to outside atmosphere through

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1 said chamber containing said second motor-blower unit and an  
opening covered with said flexible diaphragm contained in  
said diaphragm chamber and thence to outside air through  
holes contained in said chamber formed by said bell shaped  
5 end of said bell shaped chamber containing said second  
motor-blower unit; said flexible diaphragm being lifted by a  
combination of discharge pressure from said blower of said  
second motor-blower unit and a decrease in pressure in said  
spring chamber equalizing through said first equalizing line  
10 to reduce pressure in said diaphragm chamber above said  
flexible diaphragm

C. an electrical circuit containing a spring  
loaded two way switch with a connection through a first side  
of said two way switch to actuate said motor in said first  
15 motor-blower unit through a position switch in said second  
section of said hinged mattress support frame to inflate said  
bags under said leg end of said mattress support frame, said  
position switch operating to open said circuits thereby  
stopping said first blower motor unit when said leg section  
20 reaches a maximum position.

9. An adjustable bed system as in Claim 1 where said  
first inflatable means to raise and lower said head end of  
said hinged mattress support frame and said second inflatable  
means to raise and lower said leg end of said hinged mattress  
25 support comprises:

A. a flat reinforced plastic strip of a similar  
width and length of said mattress with tie down straps to go  
over said box springs and tie to said bed frame

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1           B.     a first multiplicity of inflatable plastic  
bags each equipped with means to flexibly connect to said  
first means to inflate and deflate said first inflatable  
means and each of said first multiplicity of inflatable  
5 plastic bags fastened at a center of said flat reinforced  
plastic strip

          C.     a second multiplicity of inflatable plastic  
bags each equipped with means to flexibly connect to said  
second means to inflate and deflate said second inflatable  
10 means and each of said second multiplicity of inflatable  
plastic bags fastened at a center portion of said flat  
reinforced plastic strip.

10.   An inflatable bed system comprising:

          A.     a hinged mattress support frame

15           B.     fastening means to hold said hinged mattress  
support frame to a bed above a box spring and below a  
mattress

          C.     a first inflatable means to raise and lower a  
head end of said hinged mattress support frame and a second  
20 inflatable means to raise and lower a leg end of said hinged  
mattress support frame

          D.     a first blower with suitable valves and  
switches so that said first blower may be used in inflate  
said first inflatable means to raise and lower said head end  
25 and to inflate said second inflatable means to raise and  
lower said leg end of said mattress support frame

          E.     a second blower with suitable switches and  
valves so that said second blower may be used to deflate said

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1first inflatable means to raise and lower said head end and  
to deflate said second inflatable means to raise and lower  
said leg end of said mattress support frame.

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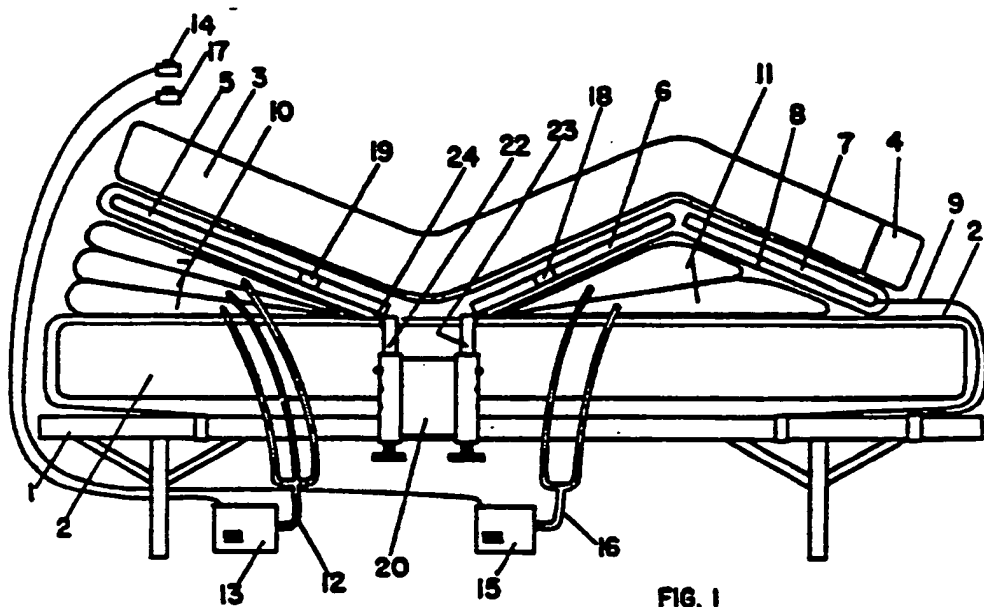


FIG. 1

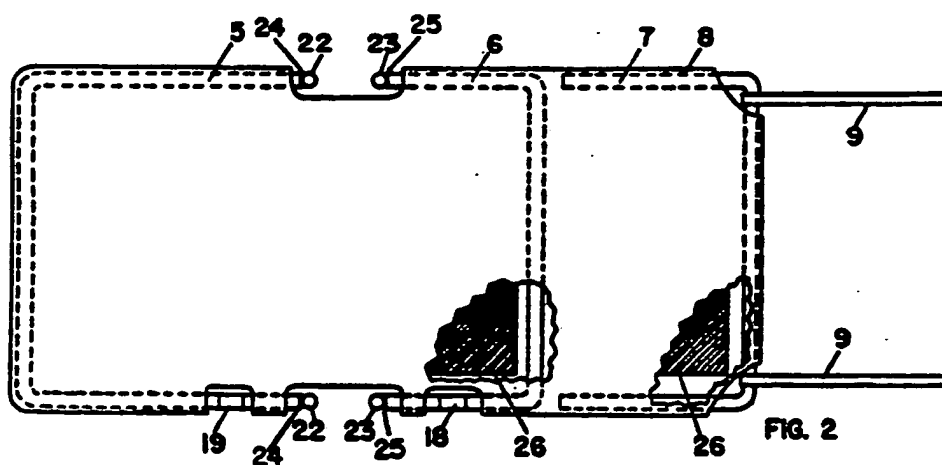


FIG. 2

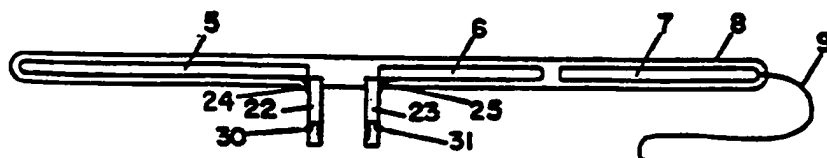
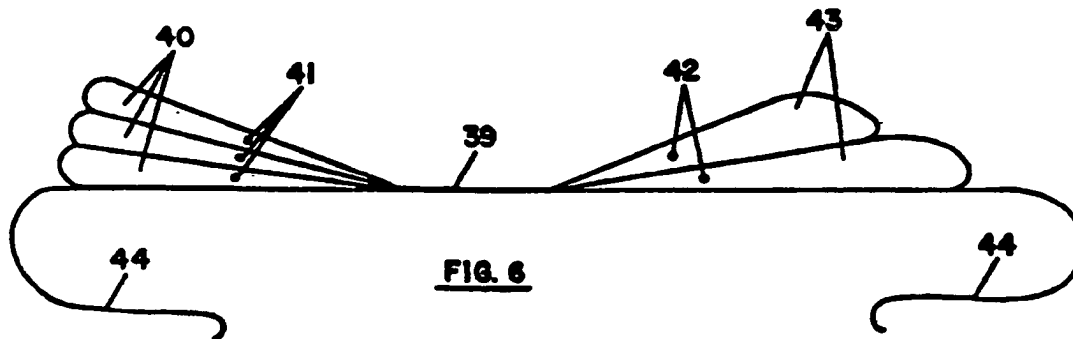
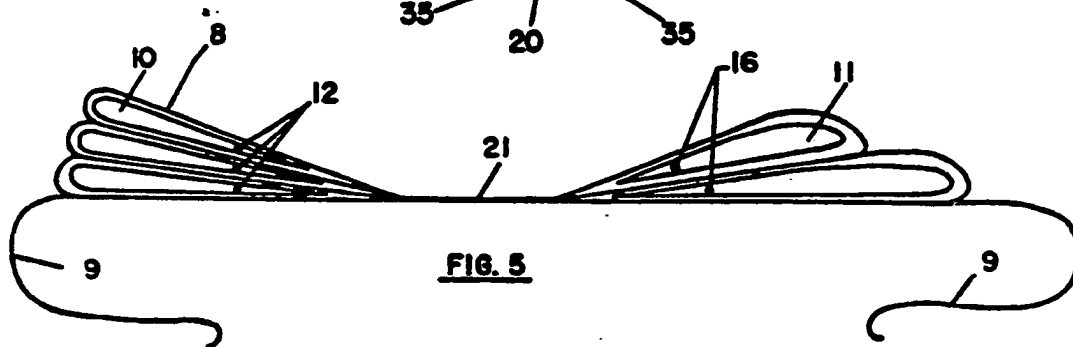
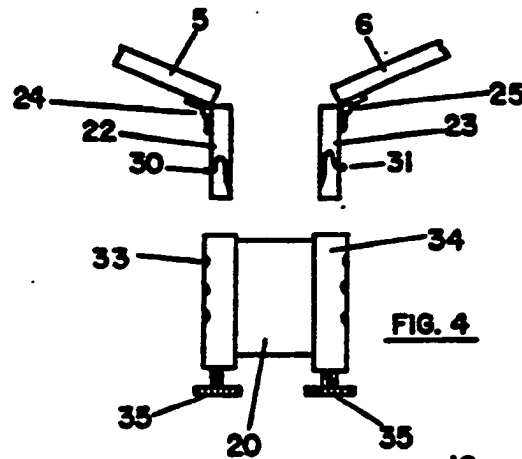


FIG. 3

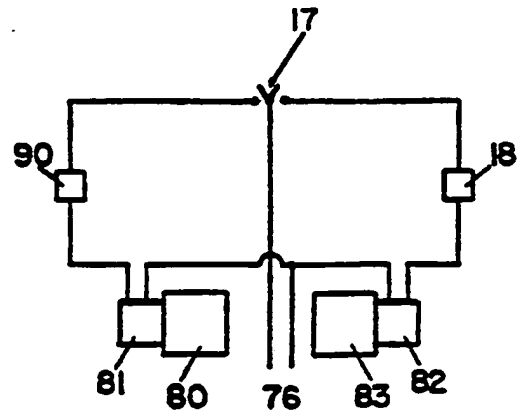
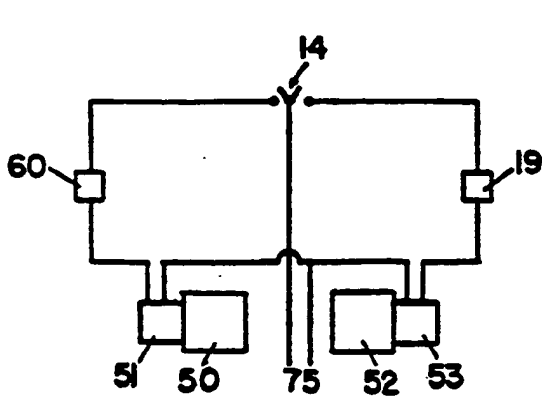
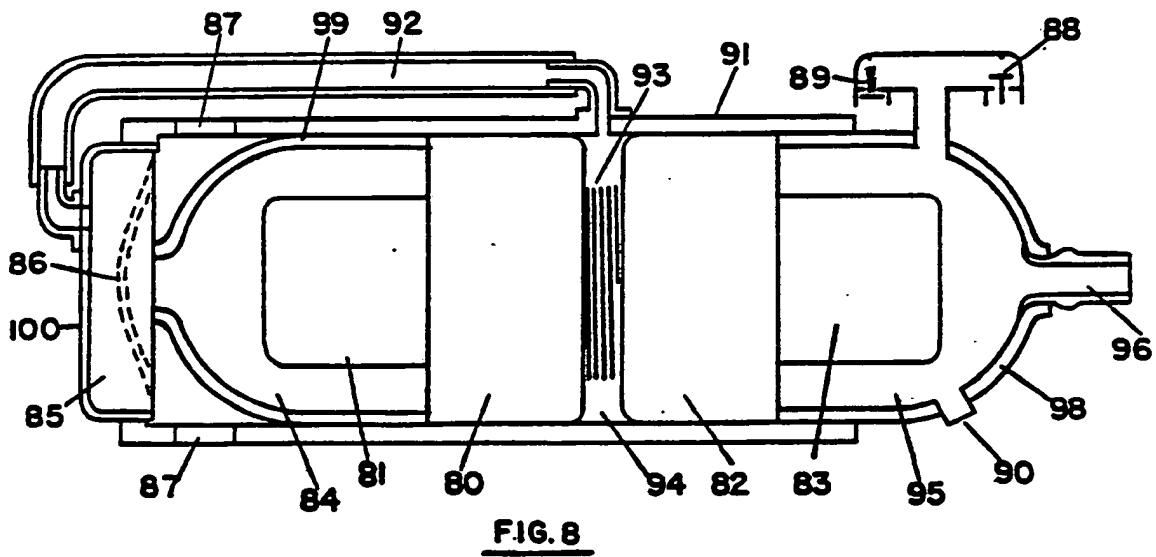
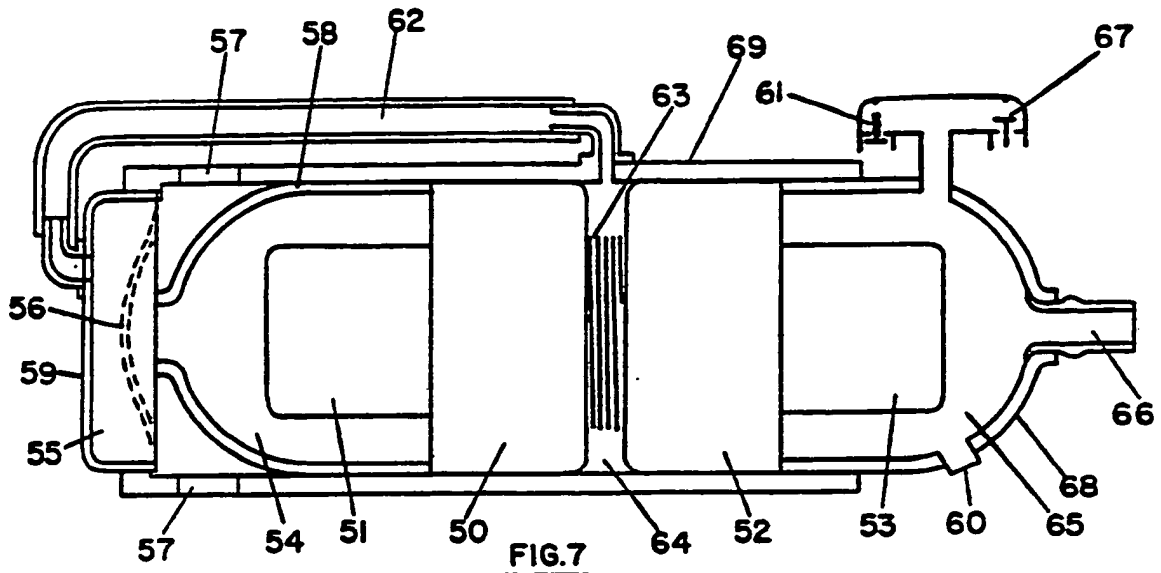
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# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 88/1287

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC (4): A47C 27/10</b> <b>U.S. Cl. 5/453</b>																							
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched <sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; border: 1px solid black; text-align: left;">Classification System</th> <th style="border: 1px solid black; text-align: left;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">U.S.</td> <td style="border: 1px solid black; padding: 5px;">5/453, 454, 455, 60, 66, 70, 71, 72, 431</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup></div>			Classification System	Classification Symbols	U.S.	5/453, 454, 455, 60, 66, 70, 71, 72, 431																	
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border: 1px solid black; text-align: left;">Category <sup>*</sup></th> <th style="width: 60%; border: 1px solid black; text-align: left;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 30%; border: 1px solid black; text-align: left;">Relevant to Claim No. <sup>13</sup></th> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">X Y</td> <td style="border: 1px solid black; vertical-align: top;">US, A, 4,287,620 (ZUR) 08 September 1981.</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1 10</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">X Y</td> <td style="border: 1px solid black; vertical-align: top;">US, A, 4,309,783 (CAMMACK ET AL) 01 January 1982.</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1 10</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">X Y</td> <td style="border: 1px solid black; vertical-align: top;">US, A, 3,781,928 (SWALLERT) 01 January 1974..</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1 10</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">A</td> <td style="border: 1px solid black; vertical-align: top;">US, A, 3,392,412 (AYMAR) 16 July 1968.</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1-10</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">A</td> <td style="border: 1px solid black; vertical-align: top;">US, A, 3,667,075 (BALLARD ET AL) 06 June 1972.</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1-10</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">A</td> <td style="border: 1px solid black; vertical-align: top;">US, A, 4,527,298 (MOULTON) 07 July 1985.</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1-10</td> </tr> </table>			Category <sup>*</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	X Y	US, A, 4,287,620 (ZUR) 08 September 1981.	1 10	X Y	US, A, 4,309,783 (CAMMACK ET AL) 01 January 1982.	1 10	X Y	US, A, 3,781,928 (SWALLERT) 01 January 1974..	1 10	A	US, A, 3,392,412 (AYMAR) 16 July 1968.	1-10	A	US, A, 3,667,075 (BALLARD ET AL) 06 June 1972.	1-10	A	US, A, 4,527,298 (MOULTON) 07 July 1985.	1-10
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>*</sup> Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>																							
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">14 October 1988</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">07 NOV 1988</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">International Searching Authority</td> <td style="border: 1px solid black; padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">ISA/US</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">             Alexander Grosz         </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	14 October 1988	07 NOV 1988	International Searching Authority	Signature of Authorized Officer	ISA/US	 Alexander Grosz													
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